To the north cloudy weather and lower temperatures prevailed. A possible explanation of the formation of the secondary is therefore that a line of discontinuity in temperature formed between the cool cloudy weather to the north and the warm clear weather to the south, and that the high lapse rate in the region of Due West, by its instability, facilitated the intrusion of colder air in the lower levels from the north and northeast.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during March, 1925*

TEMPERATURE (°C.)

| Altitude. M. S. L. m. | Broken Arrow, Okla. (233 m.) | | Drexel, Nebr. (396 m.) | | Due West, S. C. (217 m.) | | Ellendale, N. Dak. (444 m.) | | Groesbeck, Tex. (141 m.) | | Royal Center, Ind. (225 m.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Departure from 7-year mean | Mean | Departure from 10-year mean | Mean | Departure from 5-year mean | Mean | Departure from 8-year mean | Mean | Departure from 7-year mean | Mean | Departure from 7-year mean |
| Surface | 12.2 | +2.1 | 3.3 | +0.1 | 11.6 | −1.5 | −0.5 | +2.3 | 14.3 | +0.9 | 5.4 | +0.8 |
| 250 | 12.1 | +2.1 | | | 11.4 | −1.4 | | | 13.6 | +0.8 | 5.1 | +0.7 |
| 500 | 10.3 | +2.1 | 3.0 | +0.3 | 10.2 | −0.8 | −0.9 | +2.0 | 12.8 | +1.2 | 3.1 | +0.7 |
| 750 | 9.3 | +2.4 | 2.6 | +0.9 | 8.8 | −0.7 | −2.1 | +1.4 | 12.3 | +1.6 | 2.3 | +1.0 |
| 1,000 | 8.5 | +2.4 | 2.9 | +1.6 | 7.5 | −0.7 | −2.8 | +1.0 | 11.6 | +1.6 | 1.9 | +1.3 |
| 1,250 | 7.8 | +2.2 | 2.7 | +1.5 | 6.4 | −0.6 | −3.3 | +1.0 | 11.6 | +2.2 | 1.0 | +1.1 |
| 1,500 | 6.7 | +1.8 | 2.3 | +1.5 | 4.9 | −0.8 | −3.9 | +0.9 | 11.4 | +2.6 | 0.2 | +1.1 |
| 2,000 | 4.5 | +1.3 | 0.0 | +1.0 | 2.2 | −1.2 | −5.9 | +0.6 | 9.5 | +2.2 | −0.7 | +1.6 |
| 2,500 | 1.7 | +0.9 | −2.6 | +0.9 | −0.9 | −2.0 | −8.5 | +0.3 | 7.0 | +1.8 | −3.0 | +1.5 |
| 3,000 | −1.3 | +0.6 | −5.3 | +0.8 | −3.7 | −2.6 | −11.5 | −0.1 | 4.8 | +2.0 | −5.5 | +1.3 |
| 3,500 | −4.4 | +0.2 | −8.0 | +0.8 | −5.9 | −2.5 | −14.4 | −0.4 | 1.1 | +1.0 | −7.9 | +1.1 |
| 4,000 | −8.2 | −0.4 | −11.3 | +0.1 | −9.1 | −2.8 | −16.6 | 0.0 | | | −11.6 | −0.2 |
| 4,500 | | | −14.0 | +0.8 | −12.1 | −2.6 | −17.8 | +1.9 | | | | |
| 5,000 | | | | | −15.7 | −2.6 | −20.9 | +2.1 | | | | |

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during March, 1925*—Continued

RELATIVE HUMIDITY (%)

| Altitude. M. S. L. m. | Broken Arrow, Okla. (233 m.) | | Drexel, Nebr. (396 m.) | | Due West, S. C. (217 m.) | | Ellendale, N. Dak. (444 m.) | | Groesbeck, Tex. (141 m.) | | Royal Center, Ind. (225 m.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Departure from 7-yr. mean | Mean | Departure from 10-yr. mean | Mean | Departure from 5-yr. mean | Mean | Departure from 8-yr. mean | Mean | Departure from 7-yr. mean | Mean | Departure from 7-yr. mean |
| Surface | 53 | −11 | 67 | −1 | 58 | −4 | 65 | −10 | 63 | −6 | 66 | −5 |
| 250 | 53 | −11 | | | 58 | −4 | | | 63 | −5 | 66 | −5 |
| 500 | 53 | −10 | 64 | −3 | 55 | −6 | 65 | −9 | 64 | −2 | 67 | −3 |
| 750 | 50 | −11 | 57 | −8 | 53 | −8 | 63 | −6 | 58 | −5 | 64 | −3 |
| 1,000 | 47 | −12 | 50 | −11 | 50 | −11 | 59 | −6 | 53 | −6 | 60 | −4 |
| 1,250 | 42 | −13 | 46 | −10 | 47 | −14 | 54 | −7 | 45 | −9 | 57 | −4 |
| 1,500 | 40 | −11 | 43 | −9 | 46 | −15 | 50 | −8 | 38 | −12 | 53 | −6 |
| 2,000 | 37 | −7 | 45 | −6 | 45 | −11 | 50 | −6 | 35 | −7 | 46 | −10 |
| 2,500 | 36 | −5 | 46 | −5 | 45 | −6 | 50 | −6 | 36 | −2 | 44 | −11 |
| 3,000 | 35 | −4 | 45 | −7 | 39 | −7 | 55 | −2 | 30 | −5 | 36 | −18 |
| 3,500 | 29 | −9 | 47 | −5 | 34 | −9 | 56 | −1 | 29 | −4 | 6 | −45 |
| 4,000 | 30 | −8 | 49 | −2 | 36 | −9 | 44 | −11 | | | 6 | −45 |
| 4,500 | | | 46 | −8 | 36 | −8 | 37 | −18 | | | | |
| 5,000 | | | | | 47 | −2 | 37 | −19 | | | | |

VAPOR PRESSURE (mb.)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface | 7.67 | −0.74 | 5.19 | −0.09 | 8.15 | −1.79 | 3.91 | +0.04 | 11.12 | −0.30 | 6.14 | −0.25 |
| 250 | 7.61 | −0.72 | | | 8.06 | −1.72 | | | 10.75 | −0.16 | 6.05 | −0.22 |
| 500 | 6.74 | −0.66 | 4.95 | −0.05 | 7.23 | −1.52 | 3.84 | +0.08 | 10.35 | +0.55 | 5.36 | +0.01 |
| 750 | 6.01 | −0.63 | 4.40 | −0.06 | 6.37 | −1.57 | 3.44 | +0.16 | 9.06 | +0.18 | 4.80 | +0.04 |
| 1,000 | 5.38 | −0.69 | 3.97 | −0.03 | 5.52 | −1.78 | 3.00 | +0.03 | 7.84 | +0.02 | 4.41 | +0.13 |
| 1,250 | 4.61 | −0.86 | 3.64 | +0.06 | 4.72 | −1.96 | 2.62 | −0.10 | 6.39 | −0.42 | 4.01 | +0.12 |
| 1,500 | 4.15 | −0.70 | 3.25 | +0.03 | 4.02 | −1.92 | 2.26 | −0.25 | 5.16 | −0.74 | 3.52 | −0.05 |
| 2,000 | 3.11 | −0.61 | 2.79 | +0.07 | 3.08 | −1.51 | 1.99 | −0.16 | 4.06 | −0.20 | 2.84 | −0.17 |
| 2,500 | 2.46 | −0.56 | 2.38 | +0.06 | 2.29 | −1.13 | 1.57 | −0.21 | 3.61 | +0.36 | 2.45 | −0.12 |
| 3,000 | 1.90 | −0.59 | 1.93 | −0.03 | 1.48 | −0.95 | 1.29 | −0.13 | 2.27 | −0.23 | 1.70 | −0.50 |
| 3,500 | 1.14 | −0.92 | 1.71 | +0.09 | 0.91 | −0.83 | 1.05 | −0.10 | 1.37 | −0.62 | | |
| 4,000 | 0.68 | −1.02 | 1.50 | +0.11 | 0.84 | −0.54 | 0.73 | −0.17 | | | | |
| 4,500 | | | 1.34 | +0.09 | 0.74 | −0.29 | 0.65 | −0.05 | | | | |
| 5,000 | | | | | 0.89 | −0.16 | 0.61 | +0.07 | | | | |

TABLE 2.—*Free-air resultant winds (m. p. s.) during March, 1925*

| Altitude M. S. L. m. | Broken Arrow, Okla. (233 meters) | | | | Drexel, Nebr. (396 meters) | | | | Due West, S. C. (217 meters) | | | | Ellendale, N. Dak. (444 meters) | | | | Groesbeck, Tex. (141 meters) | | | | Royal Center, Ind. (225 meters) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | | 7-year mean | | Mean | | 10-year mean | | Mean | | 5-year mean | | Mean | | 8-year mean | | Mean | | 7-year mean | | Mean | | 7-year mean | |
| | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. | Dir. | Vel. |
| Surface | S. 26° W. | 3.4 | S. 11° W. | 2.1 | S. 10° E. | 1.1 | S. 51° W. | 0.6 | N. 35° W. | 1.3 | S. 70° W. | 1.8 | N. 85° W. | 2.3 | N. 42° W. | 2.1 | S. 30° E. | 1.2 | S. 5° E. | 1.1 | S. 54° W. | 1.9 | S. 45° W. | 1.7 |
| 250 | S. 26° W. | 3.4 | S. 11° W. | 2.2 | | | | | N. 40° W. | 1.3 | S. 69° W. | 2.0 | | | | | S. 22° E. | 2.1 | S. 6° E. | 1.9 | S. 41° W. | 2.0 | S. 40° W. | 1.8 |
| 500 | S. 32° W. | 5.0 | S. 13° W. | 3.6 | S. | 1.6 | S. 49° W. | 0.9 | N. 44° W. | 3.3 | S. 74° W. | 3.0 | N. 88° W. | 2.7 | N. 49° W. | 2.0 | S. 5° E. | 3.2 | S. 7° W. | 3.5 | S. 69° W. | 5.7 | S. 50° W. | 4.5 |
| 750 | S. 40° W. | 5.4 | S. 17° W. | 4.6 | S. 44° W. | 3.2 | S. 77° W. | 2.2 | N. 51° W. | 3.7 | S. 75° W. | 4.4 | W. | 4.3 | N. 73° W. | 2.5 | S. 10° W. | 3.5 | S. 19° W. | 4.2 | S. 76° W. | 6.8 | S. 57° W. | 5.7 |
| 1,000 | S. 51° W. | 5.5 | S. 30° W. | 5.3 | S. 62° W. | 3.9 | S. 84° W. | 3.1 | N. 54° W. | 4.3 | S. 74° W. | 5.5 | S. 89° W. | 5.6 | N. 80° W. | 3.1 | S. 31° W. | 3.5 | S. 33° W. | 4.9 | S. 88° W. | 7.3 | S. 65° W. | 6.5 |
| 1,250 | S. 71° W. | 6.0 | S. 43° W. | 6.0 | S. 74° W. | 5.1 | N. 86° W. | 4.1 | N. 59° W. | 4.9 | S. 74° W. | 6.8 | N. 87° W. | 6.5 | N. 75° W. | 4.0 | S. 38° W. | 3.6 | S. 41° W. | 5.3 | N. 84° W. | 9.1 | S. 73° W. | 7.7 |
| 1,500 | S. 79° W. | 6.8 | S. 59° W. | 6.2 | W. | 5.7 | N. 83° W. | 5.1 | N. 69° W. | 5.7 | S. 76° W. | 8.7 | N. 85° W. | 7.4 | N. 78° W. | 5.2 | S. 47° W. | 4.3 | S. 48° W. | 5.5 | N. 70° W. | 10.3 | S. 79° W. | 8.5 |
| 2,000 | N. 86° W. | 7.8 | S. 74° W. | 7.1 | N. 81° W. | 6.4 | N. 82° W. | 6.8 | N. 75° W. | 7.2 | S. 80° W. | 10.8 | N. 83° W. | 8.8 | N. 77° W. | 7.2 | S. 58° W. | 5.7 | S. 60° W. | 6.7 | N. 72° W. | 10.9 | S. 83° W. | 9.9 |
| 2,500 | N. 80° W. | 10.8 | S. 85° W. | 8.4 | N. 74° W. | 9.9 | N. 85° W. | 8.7 | N. 75° W. | 8.5 | S. 89° W. | 12.1 | N. 87° W. | 8.9 | N. 76° W. | 9.5 | S. 51° W. | 7.5 | S. 66° W. | 8.8 | N. 71° W. | 12.8 | S. 85° W. | 11.0 |
| 3,000 | N. 76° W. | 10.7 | N. 88° W. | 9.6 | N. 78° W. | 12.0 | N. 85° W. | 11.2 | S. 83° W. | 12.9 | S. 84° W. | 13.7 | N. 86° W. | 10.5 | N. 77° W. | 11.0 | S. 53° W. | 11.9 | S. 69° W. | 9.7 | N. 77° W. | 16.6 | S. 89° W. | 13.8 |
| 3,500 | S. 84° W. | 11.8 | S. 80° W. | 10.7 | N. 71° W. | 14.2 | N. 80° W. | 14.7 | N. 79° W. | 13.4 | S. 85° W. | 13.9 | N. 89° W. | 9.2 | N. 83° W. | 12.6 | S. 53° W. | 15.3 | S. 74° W. | 12.8 | N. 83° W. | 19.1 | S. 88° W. | 16.4 |
| 4,000 | N. 81° W. | 10.9 | S. 80° W. | 9.8 | N. 69° W. | 19.4 | N. 76° W. | 17.8 | N. 86° W. | 16.2 | S. 83° W. | 15.4 | N. 70° W. | 16.9 | N. 85° W. | 15.0 | S. 45° W. | 19.0 | S. 70° W. | 14.4 | S. 61° W. | 24.7 | S. 82° W. | 15.6 |
| 4,500 | S. 78° W. | 15.8 | S. 64° W. | 11.0 | N. 67° W. | 18.6 | N. 77° W. | 17.5 | S. 79° W. | 15.8 | S. 85° W. | 16.4 | N. 65° W. | 15.8 | N. 89° W. | 15.2 | | | | | | | | |
| 5,000 | | | | | | | | | | | | | W. | 17.0 | N. 88° W. | 17.3 | | | | | | | | |

## THE WEATHER ELEMENTS

By P. C. DAY, In Charge of Division

### PRESSURE AND WINDS

Considering the month as a whole, and for the entire country, March, 1925, did not maintain its reputation as a month of marked variability in weather conditions, though locally it established records that will doubtless stand as landmarks for future reference. Chief among these is the great tornado that occurred in the early afternoon of the 18th, extending from a point in southeastern Missouri east-northeastward for a distance of over 200 miles across southern Illinois, and into southern Indiana. The loss of life and damage to property from this tornado were the greatest ever experienced in the United States from a single storm of this character. In addition to the main storm track there were several minor tornadoes in adjacent areas. The total loss of life from these storms was about 800, while property damage amounted to about $18,000,000. A full account of these storms will appear in the April number of the REVIEW.

Other important local features of the month were the unusual cold for March over the southeastern districts on the 2d and 3d, the intense heat over portions of the same districts at the beginning of the second decade, the wide-spread lack of the precipitation usually expected in March, and the continued severe drought over the southwest.

The cyclones and anticyclones moving across the country were not unusual as to extent, the cyclones giving as a rule only light to moderate precipitation, while the anticyclones were not attended by severe cold save that

advancing into the upper Missouri Valley at the beginning of the month. This reached the central valleys and Southeastern States on the 2d and 3d, accompanied at a few points by minimum temperatures as low as ever observed in March, and at others the temperatures were as low or even lower than had occurred during the previous winter months.

The average atmospheric pressure for the month was above normal over practically the whole United States and the eastern Canadian districts. It was slightly below normal over most of western Canada and small areas in North Dakota and Minnesota. As was the case in February, the highest pressure averages were over the southeastern districts, thus favoring the eastward passage of cyclones along a more northerly course than is usual for March, with frequent warm southerly winds, particularly over the Northeastern States and Great Plains region.

The principal high winds of the month were associated with the cyclone that moved from the middle Plains northeastward to Lake Superior on the 9th and 10th, and with that moving from the southern Plains northeastward to the lower lakes from the 17th to 19th, crossing the middle Mississippi Valley on the 18th, at which time the severe storms previously mentioned occurred. The important items concerning loss of life, damage to property, etc., associated with these and other storms that occurred during the month are given in the table below.

### TEMPERATURE

The month as a whole was unusually warm and except for the first few days the daily changes were mainly unimportant, particularly during the latter half of the month.

The average temperatures were above normal, as was the case in February, over all portions of the United States and southern Canada, except for a few points along the Pacific coast from central California north to southern Washington. At numerous points the daily temperatures were normal or above almost continuously, and the monthly averages ranged generally from 4° to 6° above normal.

The principal warm periods were during the latter part of the first and the early part of the second decade, from the middle and southern Great Plains eastward to the Atlantic coast, at which time some of the highest temperatures ever observed in March occurred; about the end of the second decade over the far Southwest; and about the middle of the last decade over the more northern districts.

The lowest temperatures over the eastern half of the country were usually recorded on the 2d and 3d, at which time freezing weather occurred over the greater part of the Southeastern States and frosts occurred in the interior of northern Florida; though, on account of the short duration of freezing temperature, no important damage to vegetation resulted.

Temperatures below freezing occurred in all the States and they were as much as 20° to 30° below zero in the northern border States and at some of the high altitudes of the western mountains.

### PRECIPITATION

A marked deficiency in the precipitation existed over much of the country and the averages by States were below normal in all but New England, New York, and Montana, where small excesses occurred.

The month was remarkably dry in the southern districts, particularly in the cotton-growing sections, where, at many points, precipitation was the least reported in March for 50 years or more. In portions of the west Gulf coast sections rainfall has been deficient since the beginning of the year.

Severe drought existed at the end of the month from Texas westward. In New Mexico it has continued for a year or more, and in portions of Arizona the water supply is the lowest ever known.

In southern California, where severe drought had existed, there was very general relief during the last few days of the month, when practically the entire State had beneficial rains or snows.

### SNOWFALL

Appreciable snow occurred during the month over all central and northern districts, but the amounts were nearly everywhere less than usually fall in March.

In the districts east of the Rocky Mountains there were falls totaling from 5 to 20 inches or more in the northern portions of New England and New York, and generally from 5 to 10 inches in the Great Lakes region. Over the States from Minnesota to Montana there was considerable snow in the northern portions, particularly on the 9th and 10th.

In the western mountain regions important additions to the amounts of snow on ground at the end of February occurred in parts of California, particularly on the western slopes of the southern Sierra, as much as 100 inches being recorded locally. Generally speaking, the amount of snow on the ground over the western slopes of the Sierra at the end of March was greater than at the same time last year, though it was still materially below the normal over important districts. Over the eastern slopes of the Sierra there was a decided deficiency in the March snowfall, and the amount on the ground at the end of the month was less than at the same time last year.

Over other mountain sections the snowfall was nearly everywhere less than usually received in March, the fall being decidedly light in Utah, Arizona, New Mexico, and in the Pacific Northwest.

The outlook for the late supply of water in the main irrigation districts is generally unsatisfactory, particularly in the southern mountains, though the outlook in the drainage area of the Roosevelt Dam in Arizona is reported as good.

At the close of the month the snow had disappeared from all parts of the country save extreme northern New England, locally in the Adirondack Mountains of New York, at a few points in the upper Lake region, and at the higher elevations in the western mountains.

### RELATIVE HUMIDITY

Conforming to the rainfall conditions, the relative humidity was below normal in all parts of the country except over the northeast, and locally in a few other sections. Deficiencies were large over most of the Southern States and from the Mississippi River westward, save along the middle and north Pacific coast, where a few places had percentages only slightly less or even slightly more than the average.

### SUNSHINE AND CLOUDINESS

Due to the absence of important rainy periods in the southern districts there was an unusual amount of sunshine for March over those districts, and this condition existed over much of the Plains and Mountain regions of the West. In the far Northwest there was about the usual amount of cloudy weather, and similar conditions existed in the Great Lakes region.